0.02% of Al" as specifically recited in the solicited claims. The last paragraph of page 4 of the Official Action notes that "Less than 0.02 wt.% is no different from 0.02 wt.%." The Applicants respectfully submit that the claimed "less than 0.02%" is obviously and clearly different from the disclosed range of "0.02 – 0.10%" of Maid. There is utterly no overlap whatsoever between those two totally and completely separate ranges. Those of ordinary skill in the mathematics art clearly know that "less than 0.02" is completely different from "0.02 – 0.10."

Thus, Maid fails to disclose the claimed N/Al ratio, fails to disclose the amount of dissolved N in the steel, fails to disclose the ferrite grain size and fails to disclose the claimed Al content.

The rejection relies on Tosaka to cure those deficiencies by selecting portions of Tosaka such as an alloyed steel composition similar to Maid, made by hot rolling, cold rolling and hot galvanizing with a fine-grain ferrite grain size less than 2 μm. It is then stated that it would be obvious to make the combination.

The Applicants respectfully submit that one of ordinary skill in the art would not make the hypothetical combination. Maid relates to a hot-rolled steel. This is in sharp contrast to the cold-rolled steels of Tosaka. This is a first and stark reason why one of ordinary skill in the art might very well be reluctant to make the hypothetical combination, irrespective of any similarities between the steel compositions. It should also be noted that, even among the hot rolling, which is critical to Maid, there are sharp differences between Maid and Tosaka. For example, Maid first heats a continuously cast slab to about 1250°C and then hot rolls and finish rolls the slab to an end thickness with a finish rolling temperature as close as possible to A_{r3}. The finish-rolled sheet is then rapidly cooled at a range of 30° to 70°C/sec. Subsequently, the sheets are coiled at a temperature of 350°C to 190°C. Maid also explicitly teaches that the coiling temperature "must be adhered to according to the invention."

In sharp contrast, Tosaka heats the steel slab to a temperature of 1280° to 1180°C, hot-rolls at a finishing temperature of 900 - 800°C and then subjects the finish-rolled sheet to a coiling temperature of 650° - 500°C.

Those of ordinary skill in the art would readily see that there are dramatic differences between the coiling temperatures of Maid and Tosaka. Not only is there no overlap, but there is a vast gap between the 350° highest temperature of Maid and the 500° lowest temperature of Tosaka. This is a signal to those of ordinary skill in the art that there are sharp differences in the approach of these two methodologies. Of course, this does not even mention the fact that there are multiple subsequent treatment steps in Tosaka that are not only not contemplated in Maid, but not desired.

One of the potential consequences of these representative sharp differences can manifest itself in the amount of dissolved N content. The dramatic differences in methodology could, as readily recognized by those of ordinary skill in the art, lead to dramatic differences in the potential amount of dissolved N contained within the steel of the invention, relative to the steels of both Maid and Tosaka. The Applicants therefore respectfully submit that there is no demonstration on the record that the amount of dissolved N content would inherently be possessed by the alloy steel of Maid, especially since the alloy elements of Maid do not completely overlap with that of the invention.

It is well accepted that "inherency" must be demonstrated to be a characteristic that is necessarily present in the invention as disclosed by the prior art. There is no such demonstration on this record that the dissolved N content would inherently be present. In fact, the Applicants respectfully submit that the differences between methodology between Maid, Tosaka and the invention would lead one of ordinary skill in the art to seriously question whether the amount of dissolved N would necessarily be present. Although it might be possible for the amount of dissolved N content to be present, there is no showing on the record that it would necessarily be so.

As a consequence, the Applicants respectfully submit that one of ordinary skill in the art would not only not have incentive to make the hypothetical combination, but that there are teachings present in both references that would one of ordinary skill in the art away from making the hypothetical combination. A particular example of this is found with respect to the ferrite grain size of Tosaka. To achieve that disclosed grain size of 20 mm or less, Tosaka discloses a series of treatment steps that result in such a grain size. The Applicants respectfully submit that one of ordinary skill in the art would be faced with quite a conundrum in reasonably expecting that the ferrite grain size of 20 μm or less of Tosaka would have any chance of being present by utilizing the teachings of Maid.

As previously noted, the process steps of Maid and Tosaka are dramatically different. Therefore, the Applicants respectfully submit that one of ordinary skill in the art would have no reasonable expectation that utilizing the teachings of Maid would in any way result in ferrite grain sizes of 20 μm or less since at least half of the steps utilized to form the steels of Tosaka are not even present in Maid, much less there be any similarity to those steps. One of ordinary skill in the art would realize that, to achieve the ferrite grain size of 20 μm or less, substantial portions of the methodology of Tosaka would need to be imported as well. However, there is no teaching or suggestion to do so, no teaching or suggestion that it would be successful if the importation were to be made and, in fact, just the opposite is true. The Applicants have already shown that there are serious differences in approach to the hot rolling steps as taken by Tosaka compared to Maid. What this all means is that one of ordinary skill in the art would not make the hypothetical combination as proposed in the Official Action.

It is also important to note that, even if a hypothetical combination were to be made, the resulting combination would still fail to teach or suggest the invention as recited in the solicited claims, especially in view of the unexpected results obtained by the Applicants.

In that regard, an important function that the steel sheet of this invention has is the function in which TS increases from distortion age-hardening at the time of paint baking. This function is a completely new function which is not found in conventional steel plates. The function of the steel sheets of Maid is called "BH" (Bake Hardenability). That function is a function in which only the YP increases (Column5, lines 6 - 11). The function of BH in which TS of this invention increases is completely different.

The results achieved in this invention are reached by combining conventional functions and the known art of BH. For example, even if chemical components overlap, if the microstructure of the steel is not controlled delicately, the function of this invention is not obtained. For example, steel A1 of the comparative example of the Applicants' Table16 is a steel which combined crystal grain size of Tosaka and Maid. That steel has a 2-phase microstructure. That steel has a 0.7 or less yield ratio as shown in Maid. That steel has the same diameter of a crystal grain of 20 micrometers or less as Tosaka. The amount of dissolution N of that steel is 0.0010%. The amount of BH of that steel is 82MPa. This is almost the same as the BH of 40 to 80MPa in Maid.

However, the delta TS(s) of that steel is only 35 MPa. The delta TS(s) is 40 MPa or more in steels of this invention.

The following features are indispensable to raise TS. The Official Action helpfully indicates that the relation between the constituent features and delta TS has not been proved. This point is described in detail below.

(1) The content of aluminum is less than 0.02%.

(2) The content of N is 0.0050 to 0.0250%.

(3) N/aluminum is 0.3 or more.

(4) N of a dissolution state is 0.0010% or more.

(5) The diameter of an average crystal grain is 10 micrometers or less.

It is clear from the Applicants' Table 3 that the steel which has a chemical component range which satisfies components (1) and (2) satisfies the demand characteristic of this invention. Based on Table 3 of the Applicants' Specification, the influence of the amount of dissolution N on BH and delta TS is shown in attached Fig. 1. In the amount of dissolution N, delta TS increases rapidly at 0.0010% or more as clearly shown in attached Fig. 1. The influence constituent features (4) have on delta TS is clearly proved in attached Fig. 1. Based on Table 3, the N/aluminum ratio shows the influence which BH and delta TS have in attached Fig. 2. In order to clarify the influence of the chemical components, steel K and steel L, which do not satisfy constituent features were excepted. In the N/aluminum ratio, delta TS increases rapidly or more by 0.3 as shown in attached Fig. 2. The influence constituent features (3) have on delta TS is clearly proved in attached Fig. 2.

Based on Table16 of the Applicants' Specification, the influence that the diameter of crystal grains has on BH and delta TS is shown in attached Fig. 3. In order to clarify the influence of the diameter of the crystal grains, steel B-2, wherein the amount of dissolution N is not satisfied of constituent features, G4, J2, K1, and L1 excepted. In the diameter of the crystal grains, delta TS goes up rapidly at 10 micrometers or less as shown in attached Fig. 3. The influence which constituent features (5) and delta TS have is clearly proved in attached Fig. 3.

The correlation with components (1) - (5) and delta TS is clearly explained with the example. Although control of the chemical constitution is an indispensable requirement that alone is inadequate. A high delta TS will be realized only after strictly controlling the composition ratio, the form of existence, and the microstructure of steel. That is, if at least one of the requirements is missing, this invention is not attained. Moreover, combining the conventional technology which does not take these into consideration, will not result in this invention.

The Applicants respectfully submit that the above discussion and the attached Figures 1 – 3 developed from the Tables in the Applicants' Specification clearly demonstrate unexpected results

beyond what anyone of ordinary skill in the art could have thought possible based on either or both of Maid and Tosaka. In particular, the Applicants have shown unexpected results with respect to the amount of dissolved N, the Applicants have demonstrated unexpected results with respect to the ratio of N/Al and have further demonstrated unexpected results with respect to the diameter of the grain sizes. This demonstration is highly important because these are three totally independent and separate unexpected results not even remotely suggested by Tosaka and/or Maid. The fact that there are three unexpected results weighs heavily in favor of patentability when patentability can rely on a single showing of unexpected results, much less the three unexpected results that are demonstrated herein. Thus, the Applicants have demonstrated unexpected results with respect to Delta TS and BH, which one of ordinary skill in the art could not have anticipated, based on the primary and secondary references. The result of this is that one of ordinary skill in the art would have had no reasonable expectation of the claimed steel sheets by hypothetically combining Tosaka and Maid. The Applicants respectfully request withdrawal of the rejection on this basis as well.

In light of the foregoing, the Applicants respectfully submit that the entire Application is now in condition for allowance, which is respectfully requested.

Respectfully submitted,

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Fig. 1

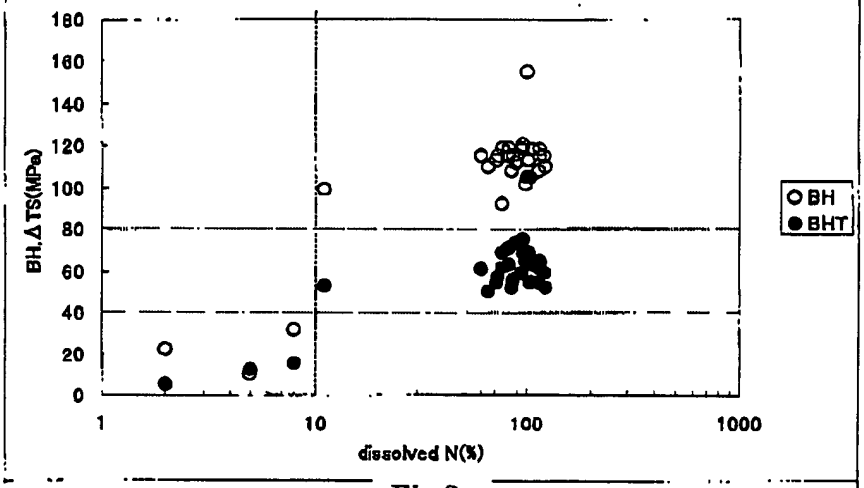

Fig.2

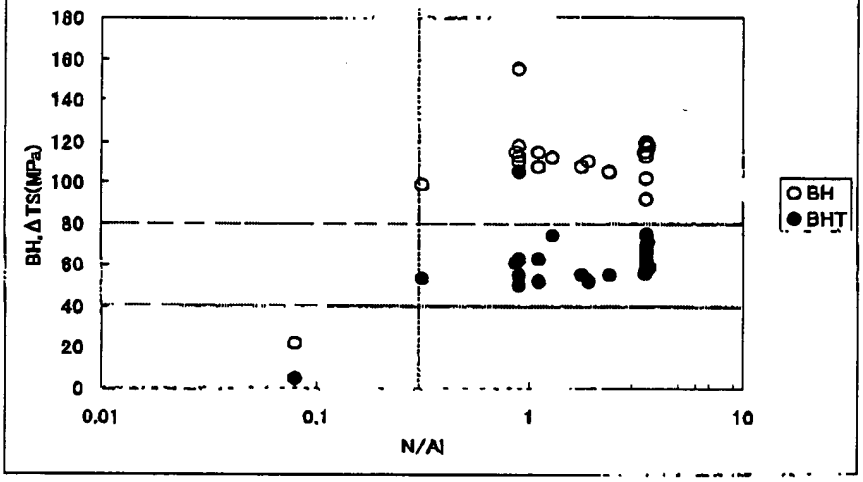

Fig.3